US011846078B2

(12) **United States Patent**
Johnson et al.

(10) **Patent No.: US 11,846,078 B2**
(45) **Date of Patent: Dec. 19, 2023**

(54) **CHUTE ROTATION ASSEMBLY FOR SNOW REMOVAL DEVICE**

(71) Applicant: **Husqvarna AB**, Huskvarna (SE)

(72) Inventors: **Mike Johnson**, Charlotte, NC (US); **Kenneth Mandeville**, Weddington, NC (US)

(73) Assignee: **HUSQVARNA AB**, Huskvarna (SE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1062 days.

(21) Appl. No.: **16/616,064**

(22) PCT Filed: **Aug. 22, 2018**

(86) PCT No.: **PCT/IB2018/056365**
§ 371 (c)(1),
(2) Date: **Nov. 22, 2019**

(87) PCT Pub. No.: **WO2019/038695**
PCT Pub. Date: **Feb. 28, 2019**

(65) **Prior Publication Data**

US 2020/0141077 A1 May 7, 2020

Related U.S. Application Data

(60) Provisional application No. 62/549,050, filed on Aug. 23, 2017.

(51) **Int. Cl.**
E01H 5/04 (2006.01)
E01H 5/09 (2006.01)

(52) **U.S. Cl.**
CPC ***E01H 5/045*** (2013.01); ***E01H 5/09*** (2013.01)

(58) **Field of Classification Search**
CPC E01H 5/045; E01H 5/09
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,334,429 A * 8/1967 Price E01H 5/04 37/243
3,808,715 A * 5/1974 Haban E01H 5/045 406/165

(Continued)

FOREIGN PATENT DOCUMENTS

WO 2012/177234 A1 12/2012

OTHER PUBLICATIONS

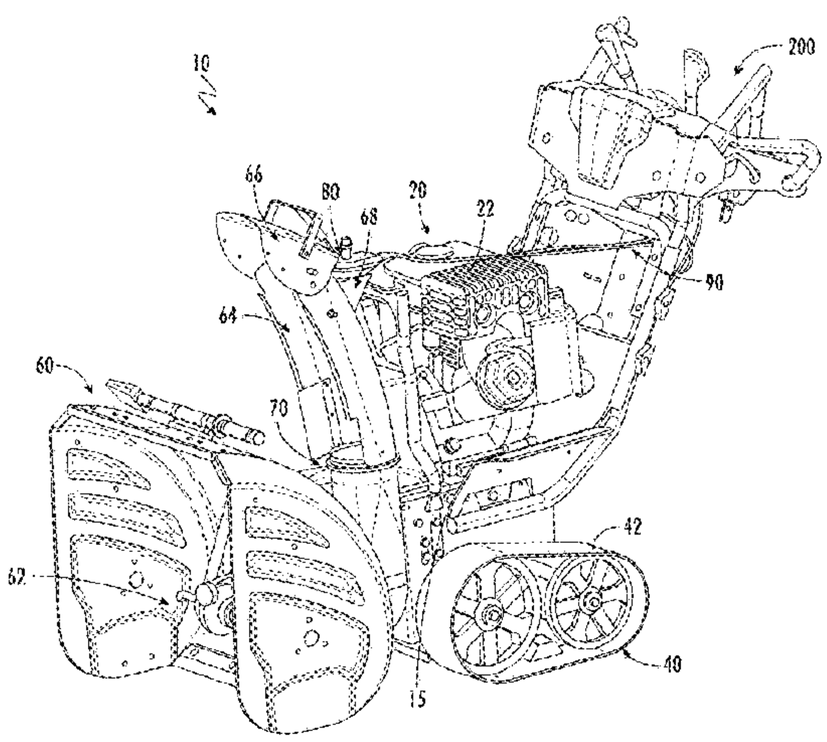
International Search Report and Written Opinion for International Application No. PCT/IB2018/056365 dated Nov. 21, 2018.

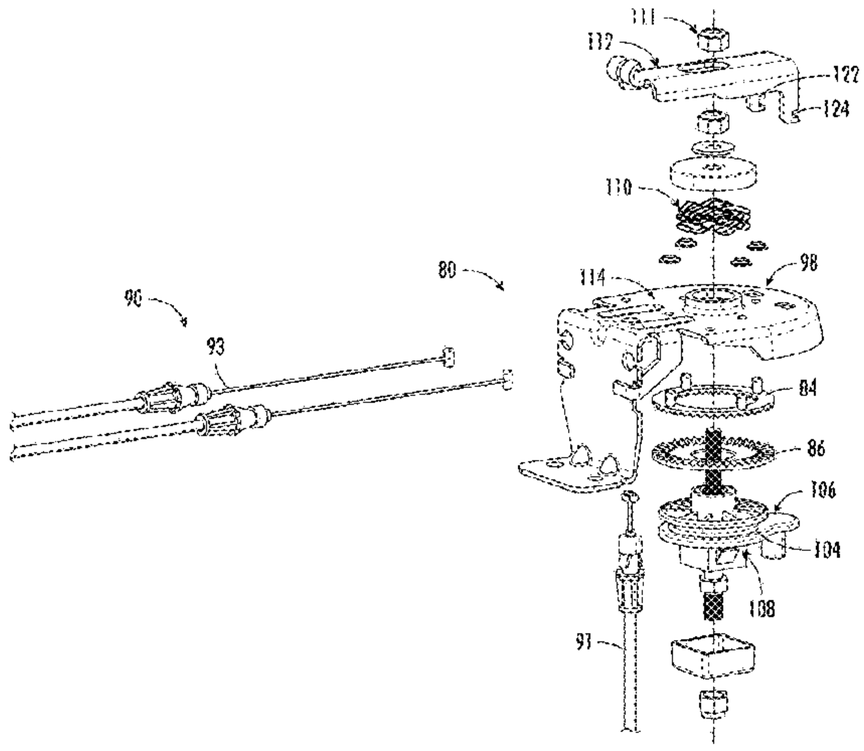
Primary Examiner — Jessica H Lutz
(74) *Attorney, Agent, or Firm* — BURR & FORMAN LLP

(57) **ABSTRACT**

A snow removal device may include an engine assembly operably coupled at least in part to a frame of the snow removal device. The snow removal device may further include a mobility assembly operably coupled to the frame and the engine assembly to provide mobility of the snow removal device responsive at least in part to operation of the engine assembly. The snow removal device may even further include an ejection assembly that includes a chute for ejecting material from the snow removal device, and a handle assembly that includes a lever assembly. Moreover, the snow removal device may also include a chute rotation assembly operably coupled to the chute of the ejection assembly. The chute rotation assembly may include a cable system, the cable system operably coupling the lever assembly to the chute rotation assembly. The chute rotation assembly may also include a disc clutch assembly configured to move between an engaged position and a disengaged position in response to actuation of the lever assembly, where when the disc clutch assembly is in the disengaged

(Continued)





position, the chute is enabled to rotate between a plurality of positions.

15 Claims, 7 Drawing Sheets

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,921,315	A *	11/1975	Tome	E01H 5/045 37/260
4,104,812	A *	8/1978	Stribiak, Jr.	E01H 5/04 37/243
4,205,468	A *	6/1980	Greider	E01H 5/045 406/161
4,409,748	A *	10/1983	Westimayer	E01H 5/045 285/272
5,438,770	A *	8/1995	Miller	E01H 5/04 37/249
6,058,629	A *	5/2000	Peterson	E01H 5/045 37/261
6,502,335	B2 *	1/2003	Prochnow	E01H 5/045 476/24
6,952,893	B1 *	10/2005	Sanderson	E01H 5/045 37/261
7,093,380	B2 *	8/2006	Hubscher	E01H 5/098 37/231
7,165,345	B2 *	1/2007	Beaudoin	E01H 5/045 37/247
7,347,013	B2 *	3/2008	Deschler	E01H 5/045 37/260
7,540,102	B2 *	6/2009	Olmr	E01H 5/04 37/249
8,016,098	B2 *	9/2011	Saiia	E01H 5/045 198/640
9,290,897	B2 *	3/2016	Schisel	E01H 5/045
9,556,572	B2 *	1/2017	Duchscherer	B62D 11/02
10,428,477	B2 *	10/2019	Hiller	E01H 5/045
10,899,266	B2 *	1/2021	Kimura	B60Q 1/0017
11,254,376	B2 *	2/2022	Mandeville	B62D 55/04
2003/0177669	A1	9/2003	Beaudoin	
2007/0175070	A1	8/2007	Deschler et al.	
2008/0163520	A1	7/2008	White et al.	
2012/0246865	A1 *	10/2012	Lauer	A01D 42/06 15/405
2014/0157633	A1 *	6/2014	Hansen	E01H 5/09 37/260
2015/0252542	A1 *	9/2015	Houle	E01H 5/098 37/259

* cited by examiner

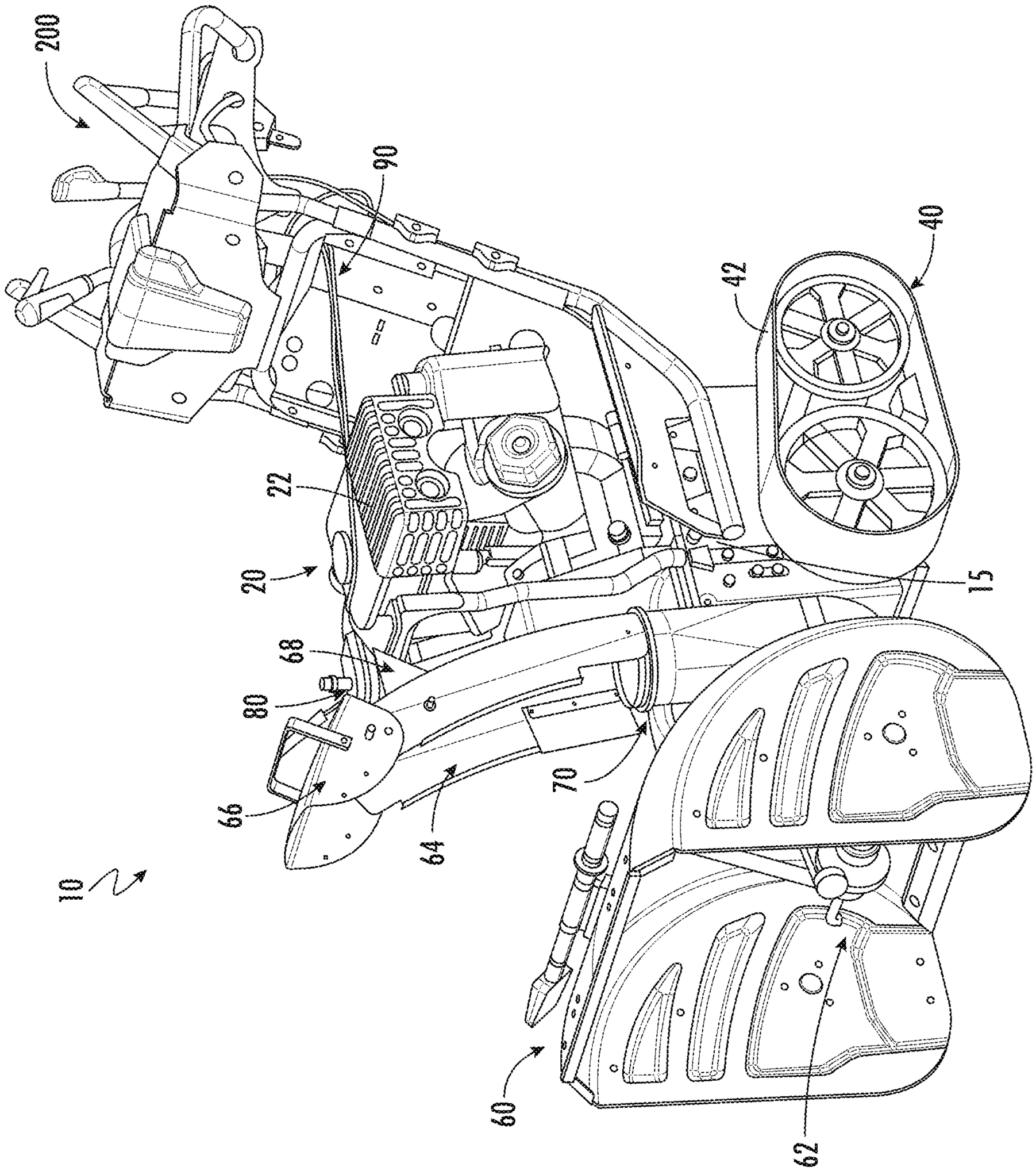


FIG. 1

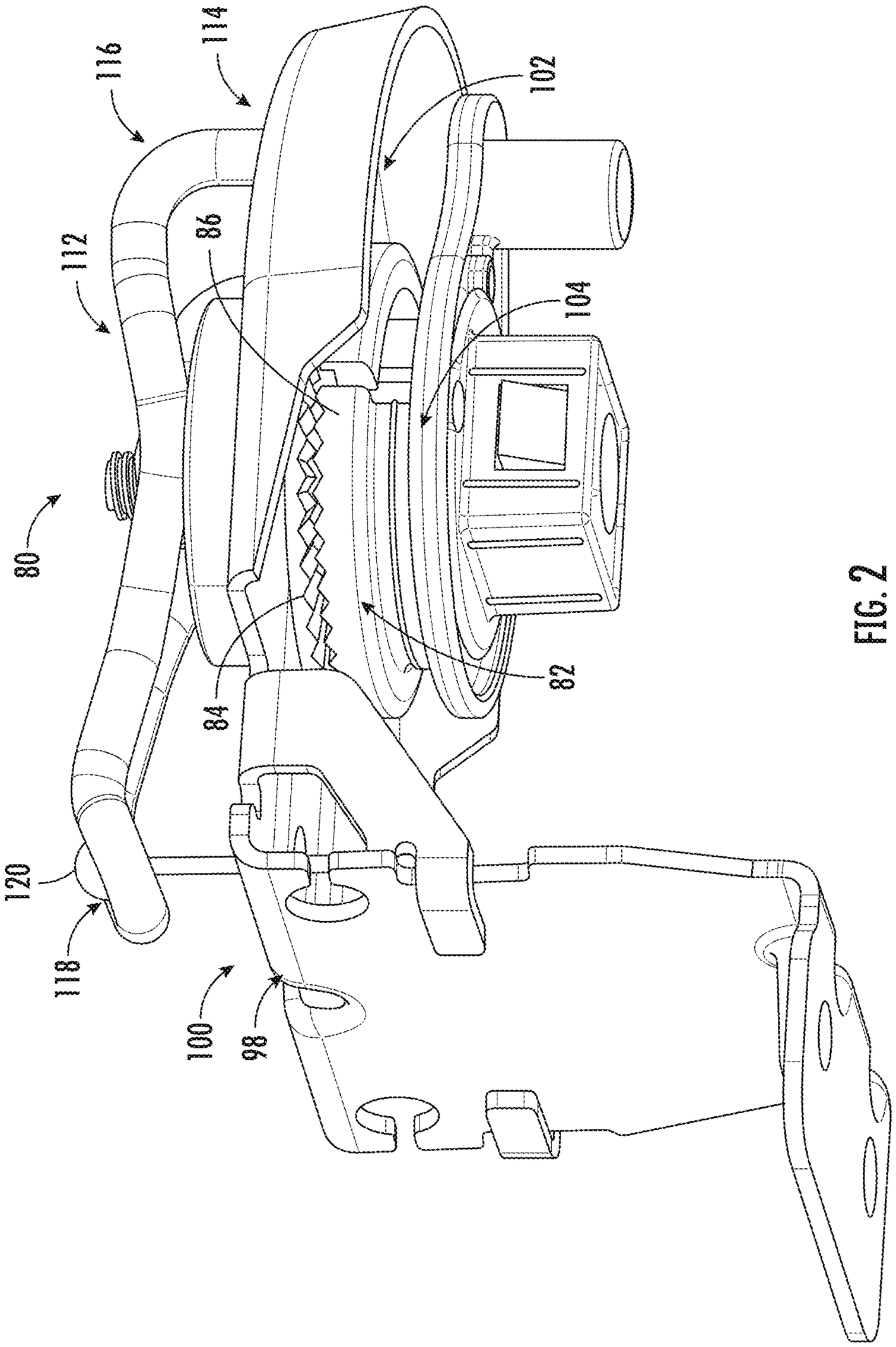


FIG. 2

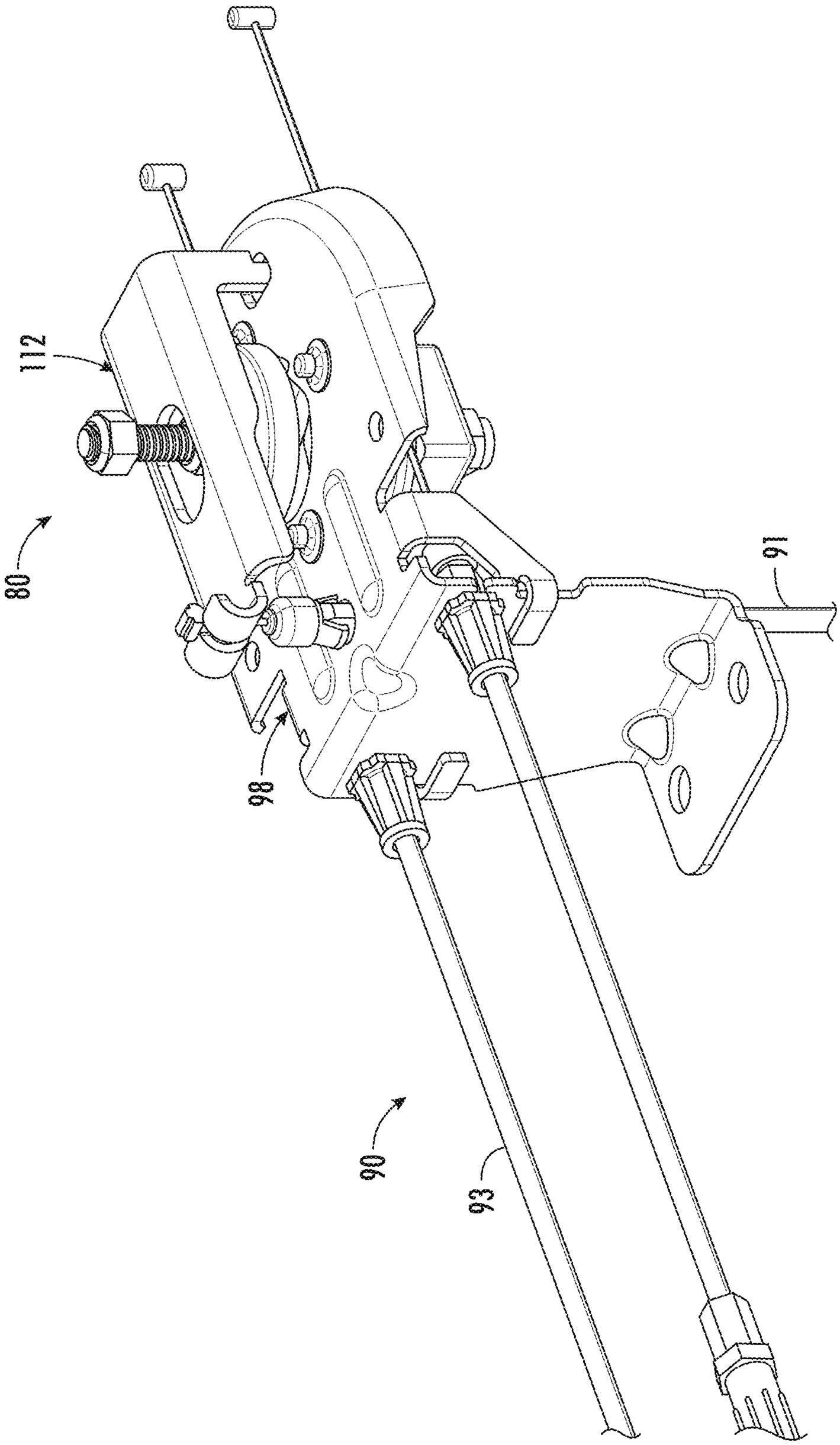


FIG. 3

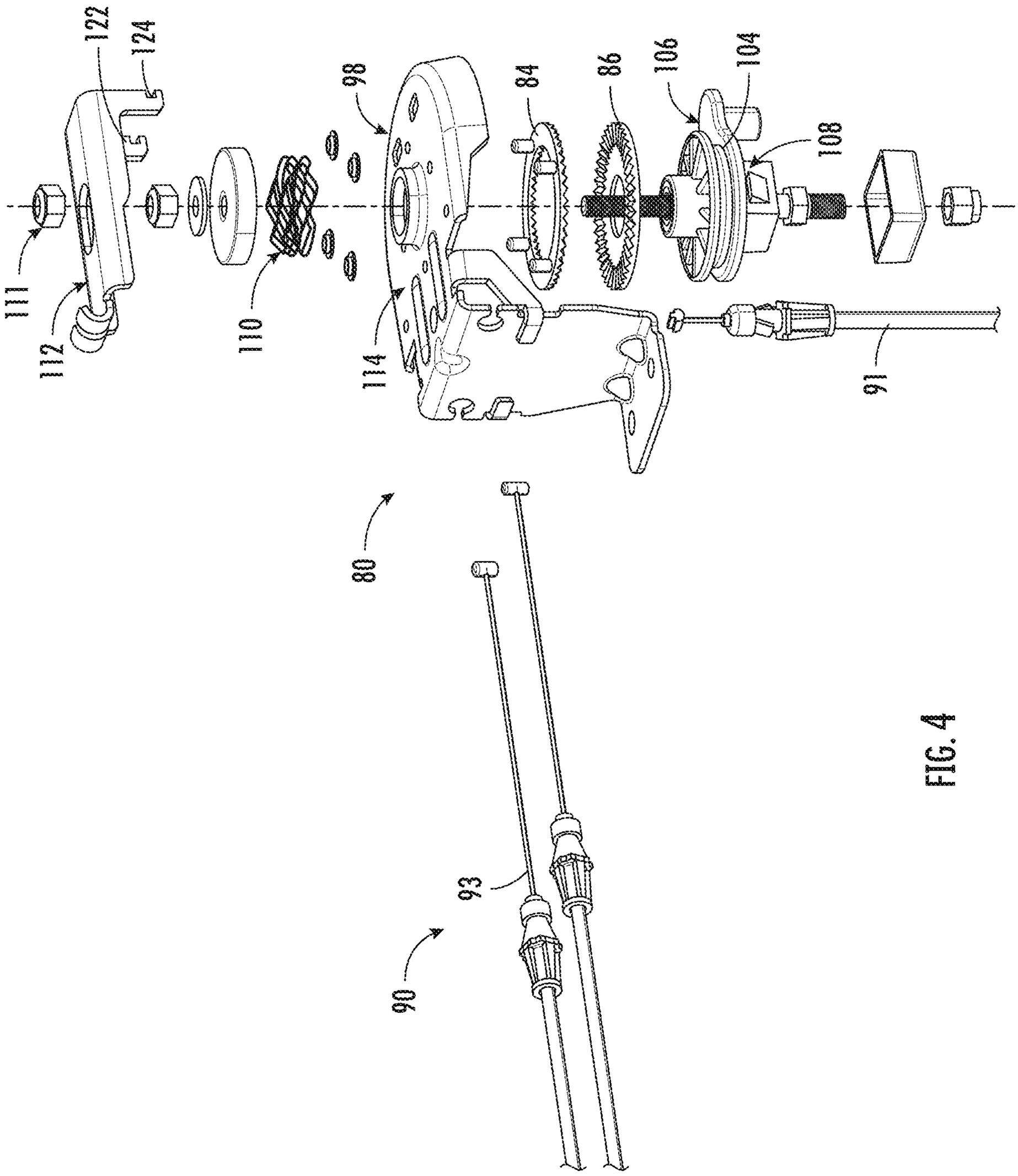


FIG. 4

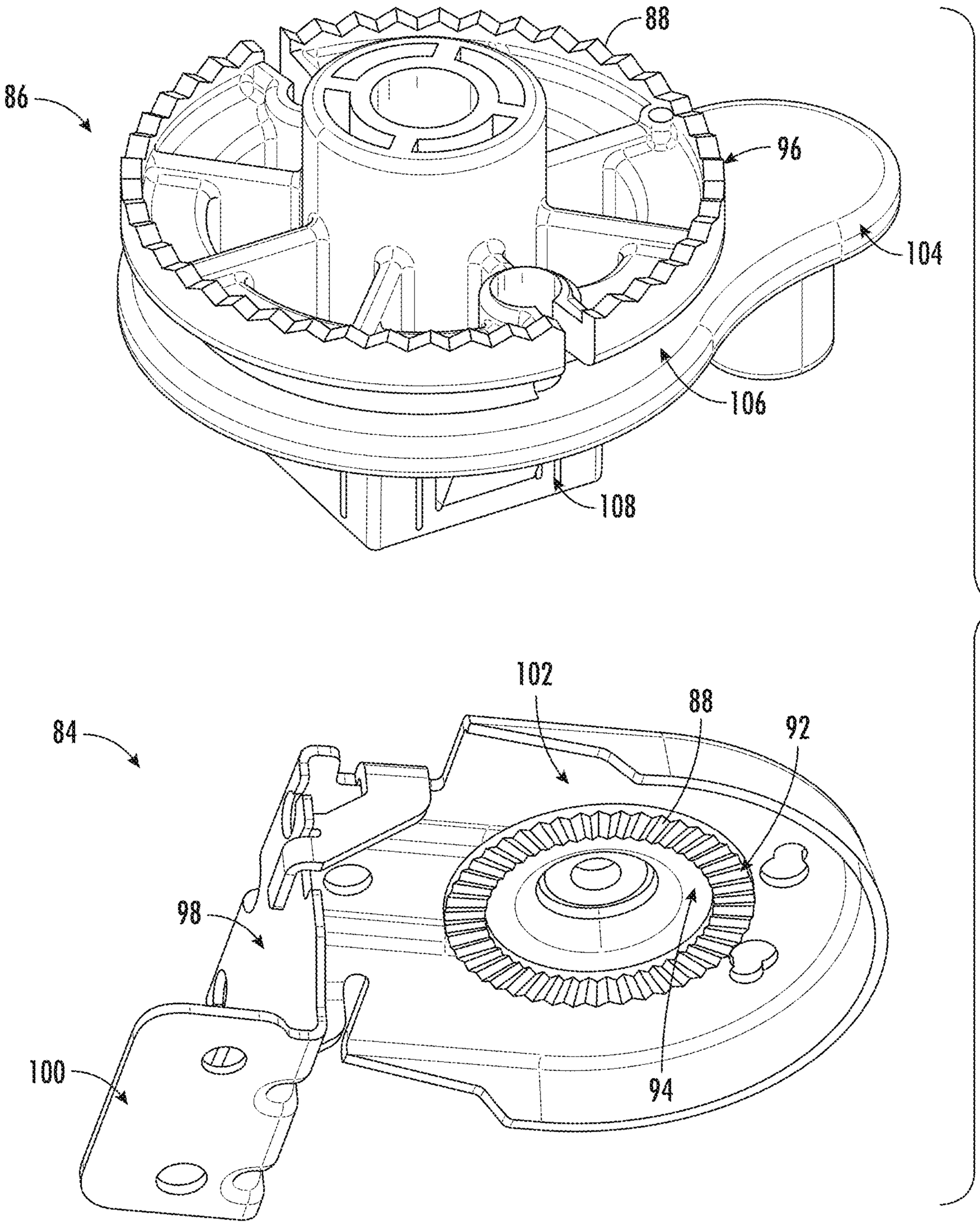


FIG. 5

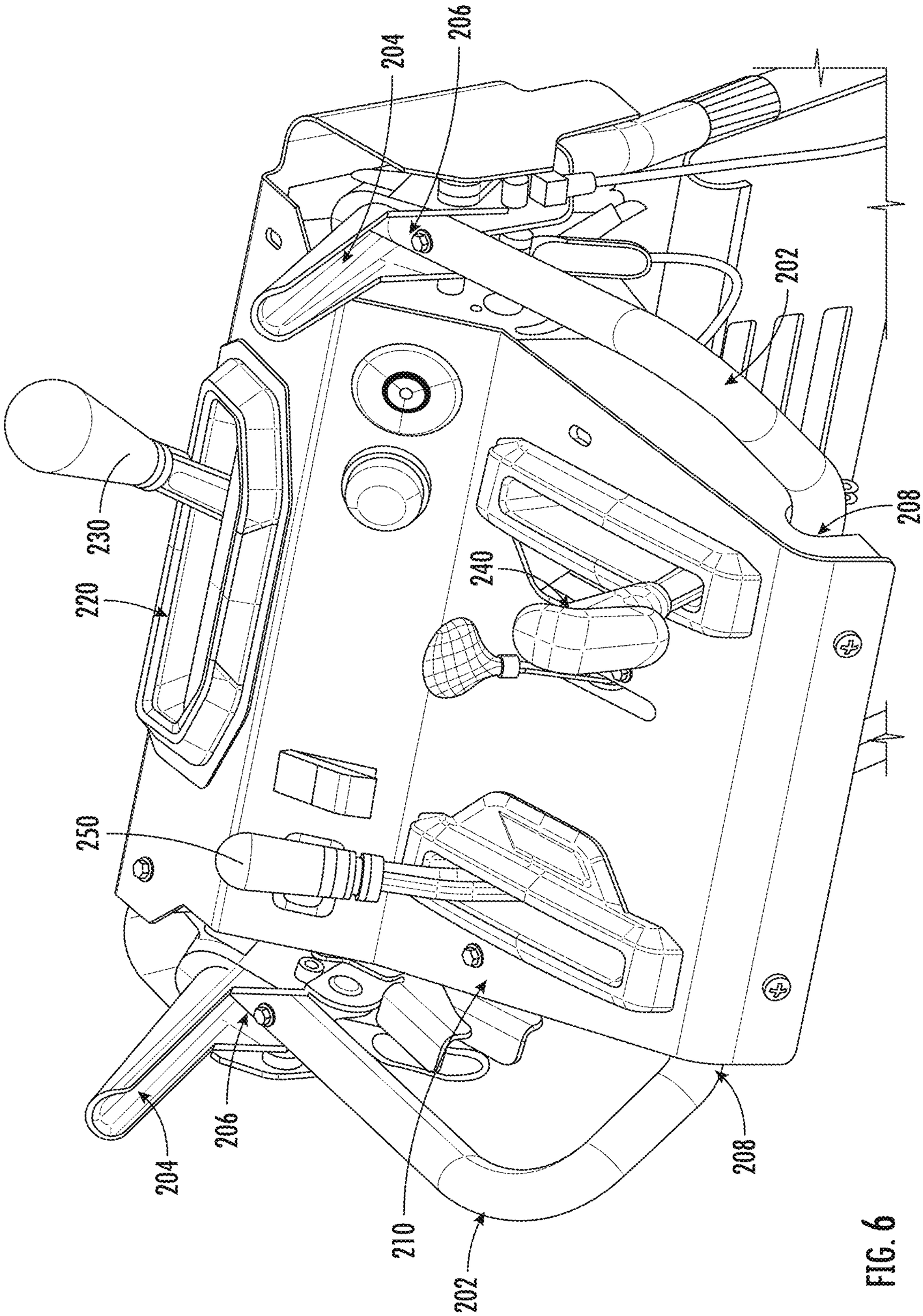


FIG. 6

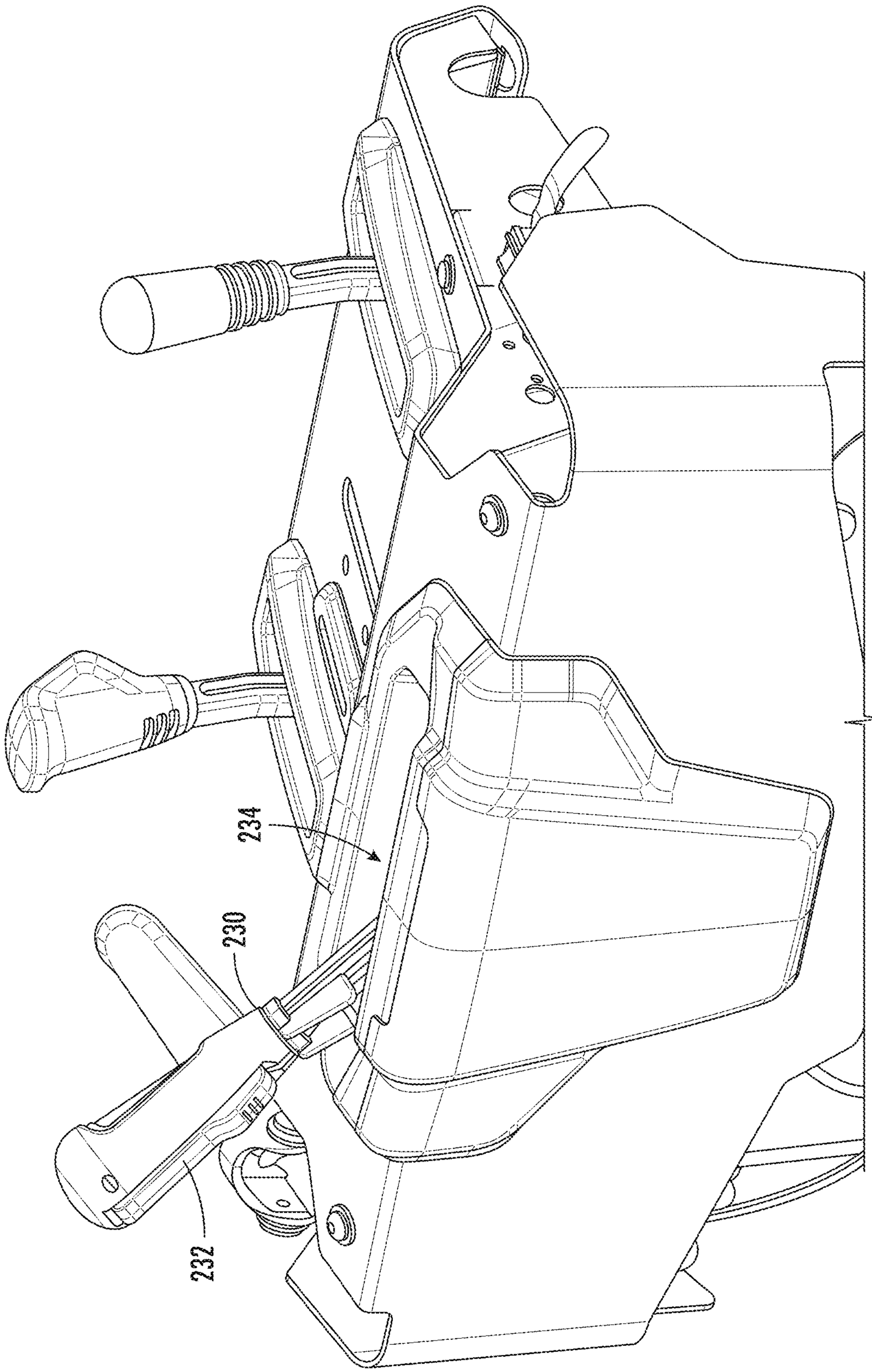


FIG. 7

CHUTE ROTATION ASSEMBLY FOR SNOW REMOVAL DEVICE

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority to U.S. application No. 62/549,050 filed Aug. 23, 2017, the entire contents of which are hereby incorporated by reference in its entirety.

TECHNICAL FIELD

Example embodiments generally relate to outdoor equipment and, more particularly, to a chute rotation assembly for use with a device that employs a chute for directing discharge material such as snow.

BACKGROUND

Lawn care and other outdoor tasks associated with grooming and maintaining property are commonly performed using various tools and/or machines that are configured for the performance of corresponding specific tasks. Certain tasks, like snow removal, are typically performed by snow removal devices. The snow removal devices may, in some cases, be walk-behind models. However, snow removal device attachments can sometimes be added to lawn tractors or other riding lawn care vehicles as well.

Walk behind snow removal devices may be single stage or dual stage snow removal devices. A single stage snow removal device may include a high speed auger blade that is rotated at the front of the snow removal device. The rotation of the auger blade may intake snow and impart momentum on the snow to eject the snow through a chute all in one stage of operation. With a dual stage snow removal device, the auger blade may feed snow into an impeller in a first stage, and the impeller may impart momentum on the snow, in a second stage, to eject the snow through a chute. In such a dual stage example, the auger may operate at lower speeds because the impeller will provide a momentum boost for snow ejection.

The chute in either a single or dual stage snow removal device may be configured to be locally repositioned in some cases. For example, the operator may walk around from the operating position (e.g., behind the snow removal device and proximate to the handles and control console) to the front or side of the snow removal device and manually adjust the direction the chute faces.

BRIEF SUMMARY OF SOME EXAMPLES

Accordingly, in order to improve operator satisfaction in connection with using a snow removal device, some example embodiments may provide a chute rotation assembly. Such a chute rotation assembly may provide operators with a relatively easy and reliable way to position the chute from a handle assembly of the snow removal device.

In one example embodiment, a snow removal device is provided. The snow removal device may include an engine assembly operably coupled at least in part to a frame of the snow removal device. The snow removal device may further include a mobility assembly operably coupled to the frame and the engine assembly to provide mobility of the snow removal device responsive at least in part to operation of the engine assembly. The snow removal device may even further include an ejection assembly that includes a chute for ejecting material from the snow removal device, and a handle assembly that includes a lever assembly. Moreover, the snow removal device may also include a chute rotation assembly operably coupled to the chute of the ejection assembly. The chute rotation assembly may include a cable system, the cable system operably coupling the lever assembly to the chute rotation assembly. The chute rotation assembly may also include a disc clutch assembly configured to move between an engaged position and a disengaged position in response to actuation of the lever assembly, where when the disc clutch assembly is in the disengaged position, the chute is enabled to rotate between a plurality of positions.

In a further example embodiment, a chute rotation assembly for a snow removal device is provided. The chute rotation assembly may include a cable system, the cable system operably coupling a lever assembly of the snow removal device to the chute rotation assembly. The chute rotation assembly may also include a disc clutch assembly configured to move between an engaged position and a disengaged position in response to actuation of the lever assembly, where when the disc clutch assembly is in the disengaged position, a chute of the snow removal device is enabled to rotate between a plurality of positions.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

Having thus described the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIG. **1** illustrates a snow removal device according to an example embodiment;

FIG. **2** illustrates a chute rotation assembly of a snow removal device according to an example embodiment;

FIG. **3** illustrates a chute rotation assembly of a snow removal device according to a further example embodiment;

FIG. **4** illustrates an exploded view of a chute rotation assembly of a snow removal device according to an example embodiment;

FIG. **5** illustrates a close-up view of a fixed disc and a chute rotator disc of a disc clutch assembly of a chute rotation assembly according to an example embodiment;

FIG. **6** illustrates a handle assembly of a snow removal device according to an example embodiment; and

FIG. **7** illustrates a close-up view of a chute rotation lever of a lever assembly of a snow removal device according to an example embodiment.

DETAILED DESCRIPTION

Some example embodiments now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all example embodiments are shown. Indeed, the examples described and pictured herein should not be construed as being limiting as to the scope, applicability or configuration of the present disclosure. Rather, these example embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like reference numerals refer to like elements throughout. Furthermore, as used herein, the term "or" is to be interpreted as a logical operator that results in true whenever one or more of its operands are true. As used herein, operable coupling should be understood to relate to direct or indirect connection that, in either case, enables functional interconnection of components that are operably coupled to each other.

Some example embodiments may improve an operator's experience associated with operating a snow removal device generally by improving the reliability of and the operator's experience associated with manipulating the position of a chute on the snow removal device. In an example embodiment, a chute rotation assembly may be provided that enables the user to adjust a position of the chute via a lever assembly that is disposed at the handle assembly of the snow removal device. Accordingly, the lever assembly may be configured to disengage and engage a disc clutch assembly of the chute rotation assembly in order to control rotation of the chute. Thus, the chute rotation assembly may be configured to move the disc clutch assembly between a disengaged position, in which the chute is configured to rotate between a plurality of positions, and an engaged position, in which the chute is not configured to rotate between the plurality of positions. The chute rotation assembly may be configured such that certain locking pieces, such as a pawl or latch, are not required to move the disc clutch assembly between the engaged and disengaged positions. Rather, the disc clutch assembly is configured such that it can simply and seamlessly move between the disengaged position and the engaged position based on the relative positions of two discs. Because there are no separate locking pieces locking the disc clutch assembly in the engaged position, any external force exerted on the chute (e.g., when an operator tries to manually position the chute) when the disc clutch assembly is in the engaged position will not cause any breakage of any parts or pieces of the chute rotation assembly. Thus, the chute rotation assembly may be configured to enable rotation of the chute while providing improved reliability and simplicity whenever the operator desires to rotate the chute.

FIG. **1** illustrates a walk behind snow removal device **10** according to an example embodiment. However, it should be appreciated that example embodiments may also be practiced in connection with any other device that may benefit from having a chute rotation assembly. Thus, chute positioning for other than walk behind snow removal device models or devices that eject materials may also be provided in accordance with some example embodiments.

As shown in FIG. **1**, in some embodiments, the snow removal device **10** may include an engine assembly **20**, a mobility assembly **40**, an ejection assembly **60**, a chute rotation assembly **80**, and a handle assembly **200**. FIG. **1** illustrates the snow removal device **10** with a hood assembly and side panels removed thereby exposing certain portions of the engine assembly **20**, the mobility assembly **40**, the ejection assembly **60**, the chute rotation assembly **80**, and the handle assembly **200**. Accordingly, it should be understood that the snow removal device **10** may include the hood assembly and the side panels that may be either removable or rotatable to expose engine assembly **20** components or other snow removal device **10** components.

As mentioned above, the snow removal device **10** may include an engine assembly **20** operably coupled to a frame **15** or chassis of the snow removal device **10**. The engine assembly **20** may include an engine **22**. The engine **22** may be a gas-powered combustion engine or another type of engine, such as a battery-powered electric motor. The engine **22** may be supported by the frame **15** of the snow removal device **10**. The engine **22** may be configured to selectively provide power to the mobility assembly **40** and the ejection assembly **60**.

Furthermore, as shown in FIG. **1**, the mobility assembly **40** may include wheels or tracks **42** on which a substantial portion of the weight of the snow removal device **10** may rest, when the snow removal device **10** is operated. The wheels or tracks **42** may also provide for mobility of the snow removal device **10**. In this regard, for example, drive power may be selectively provided to the wheels or tracks **42** in some cases from the engine **22** of the engine assembly **20**.

As further shown in FIG. **1**, the snow removal device **10** may include an ejection assembly **60**. The ejection assembly **60** of this example may include an auger **62**, which enables the removal of snow by the snow removal device **10**. When removing snow, the auger **62** may be operatively coupled to the engine assembly **20** of the snow removal device **10** such that the auger **62** may be selectively rotated about an axis that extends in a direction oriented between sides of the snow removal device **10** (and therefore parallel to the surface of the ground). Snow may be drawn inwardly and then ejected through a chute **64** of the ejection assembly **60**. It should be appreciated, however, that example embodiments of the ejection assembly **60** disclosed herein may be adapted to be used in connection with single stage or dual stage snow removal devices.

As further shown in FIG. **1**, the chute **64** of the ejection assembly **60** may include a chute deflector **66** that may be adjusted up and down to control the height of the discharge stream of snow that is ejected via the chute **64**. In an example embodiment, a sleeve portion **68** of the chute **64** may be operably coupled to a portion of the chute rotation assembly **80**. In this regard, for example, a base **70** of the chute **64** may be operably coupled to the ejection assembly **60**, and the sleeve portion **68** of the chute **64** may form a portion of the chute rotation assembly **80**. The chute rotation assembly **80**, as described in greater detail below, may enable rotation of the chute **64** between a plurality of position or orientations, as desired by the user. In some embodiments, the base **70** of the chute **64**, the sleeve portion **68** of the chute **64**, the chute **64** itself, and the chute deflector **66** may be separate pieces operably coupled together. In other cases, the base **70** of the chute **64**, the sleeve portion **68** of the chute **64**, the chute **64** itself, and the chute deflector **66** may be unitary and molded or otherwise formed from a single piece of material. Thus, the chute **64** may not include separate pieces corresponding to the each component of the chute **64**.

In an example embodiment, the chute rotation assembly **80** may be operably coupled between a portion of the frame **15** of the snow removal device **10** and the chute **64** of the ejection assembly **60**. As mentioned above, the chute **64** may be configured to rotate between a plurality of positions via the chute rotation assembly **80**. As will be described in greater detail in relation to FIG. **6** below, a lever assembly **220**, which may be located at the handle assembly **200** of the snow removal device **10**, may be operably coupled to the chute rotation assembly **80**. In particular, a cable assembly **90** of the chute rotation assembly **80** may operably couple the lever assembly **220** to the chute rotation assembly **80**. In some cases, a first portion **91** of the cable assembly **90** may be configured to control the engagement and disengagement of the chute rotation assembly **80**, and a second portion **93** of the cable assembly may be configured to control the rotation of the chute rotation assembly **80** (see FIG. **4**) Accordingly, when the user actuates the lever assembly **220**, the unlocking or release of the lever assembly **220** may cause a corresponding movement in the first portion **91** of the cable assembly **90** of the chute rotation assembly **80** thereby causing a disengagement of the chute rotation assembly **80** to enable rotation of the chute **64**. Furthermore, after the disengagement of the chute rotation assembly **80**, a left or right actuation of the lever assembly **220** may cause

a corresponding movement in the second portion **93** of the cable assembly **90** thereby causing a corresponding rotation of the chute rotation assembly **80** to rotate the chute **64**. Accordingly, when the user desires the chute **64** to be rotated to a different position, the user may unlock and actuate the lever assembly **220** to cause rotation of the chute **64**.

FIGS. **2-5** illustrate the chute rotation assembly **80** and its components according to example embodiments contained herein. FIG. **2**, for example, illustrates a perspective view of the chute rotation assembly **80** according to an example embodiment. FIG. **3** illustrates a perspective view of the chute rotation assembly **80** according to a further example embodiment. FIG. **4** illustrates an exploded view of the chute rotation assembly **80** according to an example embodiment. FIG. **5** illustrates a perspective view of a fixed disc and a chute rotator disc of the chute rotation assembly **80** according to an example embodiment.

As shown in FIG. **2**, the chute rotation assembly **80** may include a disc brake or disc clutch assembly **82**. The disc clutch assembly **82** may be configured to move between an engaged position and a disengaged position in response to movement of the lever assembly **220** by the user between an unlocked position and a locked position. FIG. **2** illustrates the disc clutch assembly **82** in the disengaged position. Accordingly, when the lever assembly **220** is in the unlocked position, the disc clutch assembly **82** may be in the disengaged position thereby enabling rotation of the chute **64** in response to actuation of the lever assembly **220** by the user of the snow removal device **10**. When the disc clutch assembly **82** is in the engaged position, the lever assembly **220** may be in the locked position and the disc clutch assembly **82** of the chute rotation assembly **80** may not be configured to enable rotation of the chute **64**. In other words, in response to the unlocking of the lever assembly **220**, the user may cause the disengagement of the disc clutch assembly **82** (i.e., movement from the engaged position to the disengaged position) thereby enabling the user to manipulate the chute **64** via the lever assembly **220** throughout the plurality of positions.

As further shown in FIGS. **2** and **4**, the disc clutch assembly **82** may include a fixed disc **84** and a chute rotator disc **86**. In accordance with an example embodiment contained herein, the fixed disc **84** may be configured to sit or lie in a first plane, and the chute rotator disc **86** may be configured to sit or lie in second plane. In some cases, the first plane and the second plane may be parallel to one other and spaced apart from each other, or in other words, one of the fixed disc **84** or the chute rotator disc **86** may be configured to sit directly above and parallel with the other of the fixed disc **84** or the chute rotator disc **86**.

As shown in FIG. **5**, each of the fixed disc **84** and the chute rotator disc **86** may include a plurality of teeth **88**. In some example embodiments, the plurality of teeth **88** of each of the fixed disc **84** and the chute rotator disc **86** may be metal. In other cases, the plurality of teeth **88** of the fixed disc **84** and the chute rotator disc **86** may be plastic or made from any other material known by one of ordinary skill in the art.

The plurality of teeth **88** of each of the fixed disc **84** and the chute rotator disc **86** may be shaped and configured to enable the intermeshing of the plurality of teeth **88** of each of the fixed disc **84** and the chute rotator disc **86** thereby enabling the engagement of the fixed disc **84** and the chute rotator disc **86**. The teeth **88** of the fixed disc **84** may extend radially around a circumference of the fixed disc **84**. Moreover, in some example embodiments, each of the plurality of teeth **88** of the fixed disc **84** may be configured to extend from a first edge **92** of the fixed disc **84** to a second edge **92** of the fixed disc **84**. Even further, each of the plurality of teeth **88** of the fixed disc **84** may be configured to extend perpendicular from a surface of the fixed disc **84** (e.g., extending out of the first plane and toward the second plane).

The teeth **88** of the chute rotator disc **86** may extend radially around a perimeter of the chute rotator disc **86**. In some cases, the teeth **88** of the chute rotator disc **86** may be disposed on a lip portion **96** of the chute rotator disc **86**. Moreover, in some example embodiments, each of the plurality of teeth **88** of the chute rotator disc **86** may be configured to extend perpendicularly away from a surface of the chute rotator disc **86**. In other words, the plurality of teeth **88** of each of the fixed disc **84** and the chute rotator disc **86** may be configured to extend out of the respective plane in which the fixed disc **84** and the chute rotator disc **86** lie (e.g., out of the second plane and toward the first plane). The orientation and shape of the plurality of teeth **88** of each the fixed disc **84** and the chute rotator disc **86** enable the intermeshing of the plurality of teeth **88** of the fixed disc **84** with the plurality of teeth **88** of the chute rotator disc **86**. The intermeshing of the plurality of teeth **88** enable the engagement of the fixed disc **84** and the chute rotator disc **86** in response to the locking of the lever assembly **220** via the user. Furthermore, the intermeshing of the plurality of teeth **88** is configured to prevent rotation of the chute **64** without the use of separate locking devices, such as a pawl or latch, attached to the either of the fixed disc **84** or the chute rotator disc **86**. In cases where a user attempts manual rotation of the chute **64** when the fixed disc **84** and the chute rotator disc **86** are engaged, there would likely be no breaking of parts. Rather, the plurality of teeth **88** of the chute rotator disc **86** would slip relative to the plurality of teeth **88** of the fixed disc **84**. Thus, even in cases where the user attempted to manually rotate the chute **64**, there would be less of a chance of breaking or damaging the chute rotation assembly **80**.

In some cases, the teeth **88** of the chute rotator disc **86** and teeth **88** of the fixed disc **84** may have different radial lengths. For example, as shown in FIG. **5**, the teeth **88** of the chute rotator disc **86** have a shorter radial length than the teeth **88** of the fixed disc **84**. However, this relationship could be reversed in some cases, or the teeth **88** of the chute rotator disc **86** and teeth **88** of the fixed disc **84** could have substantially the same radial lengths. Axial lengths may be substantially the same (and shaped the same) to maximize friction between the teeth **88** of the chute rotator disc **86** and teeth **88** of the fixed disc **84** when engaged. However, the different radial lengths may be desirable in some cases to allow for some "play" between the chute rotator disc **86** and the fixed disc **84** in case of slight misalignments therebetween.

As shown in FIGS. **2** and **5**, in some example embodiments, the fixed disc **84** may be operably coupled to a disc clutch bracket **98** of the chute rotation assembly **80**. The disc clutch bracket **98** of the chute rotation assembly **80** may be operably coupled to the portion of the frame **15** of the snow removal device **10** at a first end **100** of the disc clutch bracket **98**. The fixed disc **84** may be operably coupled to a first side **102** of the disc clutch bracket **98**.

As further shown in FIGS. **2** and **4**, the chute rotator disc **86** may be operably coupled to a chute rotor bracket **104**. In some cases, the chute rotator disc **86** may be operably coupled to a first side **106** of the chute rotor bracket **104**. On a second side **108** of the chute rotator disc **86**, the chute **64** may be operably coupled to the chute rotor bracket **104**. In some cases, the first side **106** of the chute rotor bracket **104** may be opposite from the second side **108** of the chute

rotator bracket **104**. Accordingly, it should be understood that the fixed disc **84** and the chute rotator disc **86** may be oriented or sandwiched between the first side **102** of the disc clutch bracket **98** and the first side **106** of the chute rotator bracket **104**.

As further shown in FIGS. **2-4**, the disc clutch assembly **82** may further include a biasing mechanism **110** and a release lever **112**. The release lever **112** may be operably coupled to a second side **114** of the disc clutch bracket **98**. In some cases, the second side **114** of the disc clutch bracket **98** may be opposite from the first side **102** of the disc clutch bracket **98** to which the fixed disc **84** is operably coupled. In some cases, the release lever **112** may be configured to extend along the length or diameter of the second side **114** of the disc clutch bracket **98**. Furthermore, a first end **116** of the release lever **112** may be pivotably coupled to the disc clutch bracket **98**, and a second end **118** of the release lever **112** may be operably coupled to a first end **120** of the first portion **91** of the cable assembly **90**. Accordingly, in response to movement of the first portion **91** of the cable assembly **90**, the second end **118** of the release lever **112** may be configured to pivot between a position proximate the disc clutch bracket **98** and a position extending away from the disc clutch bracket **98**. Moreover, as a second end of the first portion **91** of the cable assembly **90** may be operably coupled to the lever assembly **220**, the unlocking and locking of the lever assembly **220** may cause a corresponding movement of the first portion **91** of the cable assembly **90** which causes a corresponding movement of the chute rotation assembly **80**. Thus, in response to the unlocking of the lever assembly **220**, the second end **118** of the release lever **112** may be configured to pivot toward or proximate the disc assembly bracket **98** thereby causing the disengagement of the disc clutch assembly **82** (i.e., movement of the disc clutch assembly **82** away from the disc clutch bracket **98** thereby disengaging the chute rotator disc **86** from the fixed disc **84**). Even further, in response to the locking of the lever assembly **220**, the second end **118** of the release lever **112** may be configured to pivot away from the disc clutch bracket **98** thereby causing the engagement of the disc clutch assembly **82** (i.e., movement of the disc clutch assembly **82** toward the disc clutch bracket **98** thereby engaging the chute rotator disc **86** with the fixed disc **84**).

As shown in FIGS. **2-4**, the first end **116** of the release lever **112** may include a first leg **122** and a second leg **124**, and the first leg **122** and the second leg **124** of the release lever **112** may be pivotably coupled to the second side **114** of the disc clutch bracket **98**. Furthermore, as shown in FIGS. **2-4**, the first leg **122** and the second leg **124** may form a first portion of the release lever **112** that is configured to extend substantially perpendicular to the second side **114** of the disc clutch bracket **98**. Furthermore, a second portion of the release lever **112** that is operably coupled to the first end **120** of the first portion **91** of the cable assembly **90** may extend approximately 90 degrees away from the first portion of the release lever **112** such that the second portion of the release lever **112** extends substantially parallel to the second side **114** of the disc clutch bracket **98**. In some cases, as shown in FIG. **2**, the release lever **112** may be a substantially u-shaped metal rod. As shown in FIG. **3**, in accordance with a further example embodiment, the release lever **112** may be a substantially planar metal plate. It should be understood, however, that the release lever **112** may be formed from any known material or shape that is configured to pivot such that the engagement and disengagement of the disc clutch assembly **98** may occur.

As shown in FIG. **4**, the disc clutch assembly **82** may further include a biasing mechanism **110**. In some cases, the biasing mechanism may be a spring or the like. The biasing mechanism **110** may be operably coupled to or mounted to the second side **114** of the disc clutch bracket **98**. In some cases, the biasing mechanism **110** may be attached directly to the disc clutch bracket **98**, and the release lever **112** may be operably coupled to the biasing mechanism **110** proximate a center portion of the release lever **112**. In other words, the release lever **112** may be operably coupled to the disc clutch bracket **98** at the first end **116** of the release lever **112**, operably coupled to the first portion **91** of the cable assembly **90** at the second end **118** of the release lever **112**, and operably coupled to the biasing mechanism **110** at a position between the first end **116** and second end **118** of the release lever **112**. Thus, as the second end **118** of the release lever **112** pivots proximate or toward the disc clutch bracket **98** in response to movement or tensioning of the first portion **91** of the cable assembly **90**, the release lever **112** may overcome the tension of the biasing mechanism **110** to push (via a nut/bolt assembly **111**, as discussed below) the chute rotator disc **86** away from the fixed disc **84** thereby causing disengagement of the chute rotator disc **86** and the fixed disc **84**. Furthermore, in response to the locking of the lever assembly **220**, tension of the first portion **91** of the cable assembly **90** may be released. Accordingly, the biasing mechanism **110** may push the second end **118** of the release lever **112** away from the disc clutch bracket **98** causing the engagement of the fixed disc **84** and the chute rotator disc **86**. It should be understood that the fixed disc **82**, the chute rotator disc **86**, the release lever **112**, and the biasing mechanism **110** may be operably coupled through a center portion of each of the fixed disc **82**, the chute rotator disc **86**, the release lever **112**, and the biasing mechanism **110** via a shaft, nut/bolt assembly **111**, or the like.

FIG. **6** illustrates the handle assembly **200** according to an example embodiment. The handle assembly **200** may be provided to be accessible from a rear of the snow removal device **10** by an operator standing or walking behind the snow removal device **10** (e.g., at an operator's station) and capable of pushing, steering, or otherwise controlling movement of the snow removal device **10** using the handle assembly **200** or some other steering assembly. In some examples, the handle assembly **200** may include at least two arms **202** that may extend up and rearward away from the engine assembly **20** to provide a structure for an operator to hold in order to facilitate direction and operation of the snow removal device **10**. In some cases, the arms **202** may extend substantially parallel to each other. In some cases, the arms **202** may include handles **204** at a first end **206** of each respective one of the arms **202**. In some cases, the handles **204** may include controls for snow removal device **10** operation in some cases.

In some example embodiments, the snow removal device **10** may further include a console **210** disposed to extend between the arms **202**. In some example embodiments, the console **210** may provide some degree of structural support for respective second ends **208** of the arms **202**. Alternatively or additionally, the console **210** may provide a structure to which accessories or components of the snow removal device **10** may be added. For example, in some embodiments, the console **210** may provide a structure for supporting the lever assembly **220**.

The lever assembly **220** may include a chute rotation lever **230**, a machine speed lever **240**, and a chute deflector lever **250** Accordingly, the chute rotation lever **230** may be configured to control the rotation of the chute **64**, as desired

by the user. The machine speed lever **240** may be configured to control the speed of the snow removal device **10**, and the chute deflector lever **250** may be configured to control the height of the chute deflector **66**.

FIG. **7** illustrates a close-up view of the chute rotation lever **230** of the lever assembly **220** according to an example embodiment. As mentioned above, the chute rotation lever **230** of the lever assembly **200** may be configured to control the rotation of the chute **64**. In order to control the chute **64**, the cable assembly **90** may be operably coupled to the chute rotation assembly **80**, and a second end of the cable assembly **90** may be operably coupled to the chute rotation lever **230**. Accordingly, in response to unlocking of the chute rotation lever **230**, the chute rotation lever **230** may cause movement of the first portion **91** of the cable assembly **90** which causes a disengagement of the chute rotation assembly **80**.

In some cases, the chute rotation lever **230** may include a trigger **232** that may be configured to unlock the chute rotation lever **230**. It should be understood that in some embodiments the trigger **232** may be configured to extend toward the rear of the snow removal device **10** (e.g., in the direction toward the least two arms **202**), as shown in FIG. **1**. In other example embodiments, as shown in FIGS. **6** and **7**, the trigger **232** may be configured to extend toward the front of the snow removal device **10** (e.g., in the direction toward the chute **64**).

In response to actuation of the trigger **232** of the chute rotation lever **230**, the chute rotation lever **230** may become unlocked thereby causing a movement of the first portion **91** of the cable assembly **90**, which causes the disengagement of the chute rotation assembly **80**. Furthermore, in response to the unlocking of the chute rotation lever **230** via the trigger **232**, the chute rotation lever **230** may be configured to move left and right in a slot **234** that houses the chute rotation lever **230**. In other words, after the actuation of the trigger **232** of the chute rotation lever **230** causes disengagement of the chute rotation assembly **80**, the left and right movement the chute rotation lever **230** may cause a corresponding movement of the second portion **93** of the cable assembly **91** thereby enabling rotation of the chute **64**. In other words, the user of the snow removal device **10** may actuate the trigger **232** of the chute rotation lever **230** to disengage the chute rotation assembly **80** to enable rotation of the chute **64**. Upon the disengagement of the chute rotation assembly **80**, the user may pivot the chute rotation lever **230** left or right along the slot **234** to cause a corresponding rotation of the chute **64**. For example, a movement of the chute rotation lever **230** in a left direction may cause a corresponding movement of the chute **64** to the left or in a counter-clockwise direction, and a movement of the chute rotation lever **230** in a right direction may cause a right or clockwise direction movement of the chute **64**.

Example embodiments therefore represent a snow removal device. The snow removal device may include an engine assembly operably coupled at least in part to a frame of the snow removal device. The snow removal device may further include a mobility assembly operably coupled to the frame and the engine assembly to provide mobility of the snow removal device responsive at least in part to operation of the engine assembly. The snow removal device may even further include an ejection assembly comprising a chute for ejecting material from the snow removal device, and a handle assembly that includes a lever assembly. Moreover, the snow removal device may also include a chute rotation assembly operably coupled to the chute of the ejection assembly. The chute rotation assembly may include a cable system, the cable system operably coupling the lever assembly to the chute rotation assembly. The chute rotation assembly may also include a disc clutch assembly configured to move between an engaged position and a disengaged position in response to actuation of the lever assembly, where when the disc clutch assembly is in the disengaged position, the chute is enabled to rotate between a plurality of positions.

In some embodiments, additional optional structures and/or features may be included or the structures/features described above may be modified or augmented. Each of the additional features, structures, modifications, or augmentations may be practiced in combination with the structures/features above and/or in combination with each other. Thus, some, all or none of the additional features, structures, modifications, or augmentations may be utilized in some embodiments. Some example additional optional features, structures, modifications, or augmentations are described below, and may include, for example, that the disc clutch assembly may include a fixed disc and a chute rotator disc, where when the fixed disc and the chute rotator disc are in the disengaged position, the chute may be enabled to rotate between the plurality of positions. Alternatively or additionally, the fixed disc may be configured to lie in a first plane, and where the chute rotator disc may be configured to lie in a second plane, the first plane and the second plane being parallel. In some cases, the fixed disc and the chute rotator disc may each include a plurality of teeth, where the plurality of teeth of each of the fixed disc and the chute rotator disc may be configured to be intermeshed when the fixed disc and the chute rotator disc are in the engaged position such that the chute is not enabled to rotate between the plurality of positions. Alternatively or additionally, each of the plurality of teeth may be configured to extend perpendicularly away from a respective surface of the fixed disc or the chute rotator disc out of the respective first plane or second plane. Alternatively or additionally, the plurality of teeth may be metal. In other example embodiments, the disc clutch assembly may include a release lever, where a portion of the release lever may be operably coupled to a first portion of the cable assembly. Alternatively or additionally, the disc clutch assembly further includes a disc clutch bracket, where the release lever may be configured to extend across a diameter of the disc clutch bracket, and where a first end of the release lever may be pivotably coupled to the disc clutch bracket, and where a second end of the release lever may be operably coupled to the first portion of the cable assembly. Alternatively or additionally, in response to actuation of the lever assembly, the release lever may be configured to pivot in a direction toward the disc clutch bracket thereby causing the disc clutch assembly to move from the engaged position to the disengaged position. In some cases, the disc clutch assembly may further include a biasing mechanism, where the biasing mechanism may be operably coupled to the release lever and the disc clutch bracket, where in response to actuation of the lever assembly, the release lever may pivot to overcome a biasing force of the biasing assembly thereby causing the disc clutch assembly to move from the engaged position to the disengaged position. Alternatively or additionally, the biasing mechanism may be a spring. In further example embodiments, the chute may include a deflector configured to control a height of a discharge stream of the ejected material. Alternatively or additionally, the lever assembly may include a chute rotation lever and a chute discharge lever, where the chute rotation lever may be configured to control the chute rotation assembly, and where the chute discharge lever may be

configured to control the deflector. In some cases, the chute rotation lever may include a trigger, where in response to actuation of the trigger, the disc clutch assembly may be configured to move from the engaged position to the disengaged position.

Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Moreover, although the foregoing descriptions and the associated drawings describe exemplary embodiments in the context of certain exemplary combinations of elements and/or functions, it should be appreciated that different combinations of elements and/or functions may be provided by alternative embodiments without departing from the scope of the appended claims. In this regard, for example, different combinations of elements and/or functions than those explicitly described above are also contemplated as may be set forth in some of the appended claims. In cases where advantages, benefits or solutions to problems are described herein, it should be appreciated that such advantages, benefits and/or solutions may be applicable to some example embodiments, but not necessarily all example embodiments. Thus, any advantages, benefits or solutions described herein should not be thought of as being critical, required or essential to all embodiments or to that which is claimed herein. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

That which is claimed:

1. A snow removal device comprising:

an engine assembly operably coupled at least in part to a frame of the snow removal device;

a mobility assembly operably coupled to the frame and the engine assembly to provide mobility of the snow removal device responsive at least in part to operation of the engine assembly;

an ejection assembly comprising a chute for ejecting material from the snow removal device;

a handle assembly comprising a lever assembly; and

a chute rotation assembly operably coupled to the chute of the ejection assembly, wherein the chute rotation assembly comprises:

a cable system, the cable system operably coupling the lever assembly to the chute rotation assembly; and

a disc clutch assembly configured to move between an engaged position and a disengaged position in response to actuation of the lever assembly;

wherein, when the lever assembly is in an unlocked position, the disc clutch assembly is in the disengaged position and the chute is enabled to rotate between a plurality of positions;

wherein, when the lever assembly is in a locked position, the disc clutch assembly is in the disengaged position and the chute is not enabled to rotate via the lever assembly between the plurality of positions;

wherein the disc clutch assembly comprises a fixed disc and a chute rotator disc, wherein when the fixed disc and the chute rotator disc are in the disengaged position, the chute is enabled to rotate between the plurality of positions,

wherein the fixed disc and the chute rotator disc each comprise a plurality of teeth, wherein the plurality of teeth of each of the fixed disc and the chute rotator disc are configured to be intermeshed when the fixed disc and the chute rotator disc are in the engaged position such that the chute is not enabled to rotate between the plurality of positions.

2. The snow removal device of claim **1**, wherein the fixed disc is configured to lie in a first plane, and wherein the chute rotator disc is configured to lie in a second plane, the first plane and the second plane being parallel.

3. The snow removal device of claim **1**, wherein each of the plurality of teeth is configured to extend perpendicularly away from a respective surface of the fixed disc or the chute rotator disc out of the respective first plane or second plane.

4. The snow removal device of claim **1**, wherein the plurality of teeth are metal.

5. The snow removal device of claim **1**, wherein the chute comprises a deflector configured to control a height of a discharge stream of the ejected material.

6. The snow removal device of claim **5**, wherein the lever assembly comprises a chute rotation lever and a chute discharge lever, wherein the chute rotation lever is configured to control the chute rotation assembly, and wherein the chute discharge lever is configured to control the deflector.

7. The snow removal device of claim **6**, wherein the chute rotation lever comprises a trigger, wherein in response to actuation of the trigger, the disc clutch assembly is configured to move from the engaged position to the disengaged position.

8. A snow removal device comprising:

an engine assembly operably coupled at least in part to a frame of the snow removal device;

a mobility assembly operably coupled to the frame and the engine assembly to provide mobility of the snow removal device responsive at least in part to operation of the engine assembly;

an ejection assembly comprising a chute for ejecting material from the snow removal device;

a handle assembly comprising a lever assembly; and

a chute rotation assembly operably coupled to the chute of the ejection assembly, wherein the chute rotation assembly comprises:

a cable system, the cable system operably coupling the lever assembly to the chute rotation assembly, and

a disc clutch assembly configured to move between an engaged position and a disengaged position in response to actuation of the lever assembly;

wherein, when the lever assembly is in an unlocked position, the disc clutch assembly is in the disengaged position and the chute is enabled to rotate between a plurality of positions;

wherein, when the lever assembly is in a locked position, the disc clutch assembly is in the disengaged position and the chute is not enabled to rotate via the lever assembly between the plurality of positions;

wherein the disc clutch assembly further comprises a release lever, wherein a portion of the release lever is operably coupled to a first portion of the cable assembly;

wherein the disc clutch assembly further comprises a disc clutch bracket, wherein the release lever is configured to extend across a diameter of the disc clutch bracket, and wherein a first end of the release lever is pivotably coupled to the disc clutch bracket, and wherein a second end of the release lever is operably coupled to the first portion of the cable assembly.

9. The snow removal device of claim 8, wherein in response to actuation of the lever assembly, the release lever is configured to pivot in a direction toward the disc clutch bracket thereby causing the disc clutch assembly to move from the engaged position to the disengaged position.

10. The snow removal device of claim 9, wherein the disc clutch assembly further comprises a biasing mechanism, wherein the biasing mechanism is operably coupled to the release lever and the disc clutch bracket, wherein in response to actuation of the lever assembly, the release lever pivots to overcome a biasing force of the biasing assembly thereby causing the disc clutch assembly to move from the engaged position to the disengaged position.

11. The snow removal device of claim 10, wherein the biasing mechanism is a spring.

12. A chute rotation assembly for a snow removal device, the chute rotation assembly comprising:

a cable system, the cable system operably coupling a lever assembly of the snow removal device to the chute rotation assembly; and

a disc clutch assembly configured to move between an engaged position and a disengaged position in response to actuation of the lever assembly;

wherein, when the lever assembly is in an unlocked position, the disc clutch assembly is in the disengaged position and a chute of the snow removal device is enabled to rotate between a plurality of positions;

wherein, when the lever assembly is in a locked position, the disc clutch assembly is in the disengaged position and the chute is not enabled to rotate via the lever assembly between the plurality of positions,

wherein the disc clutch assembly further comprises a release lever, wherein a portion of the release lever is operably coupled to a first portion of the cable assembly,

wherein the disc clutch assembly further comprises a disc clutch bracket, wherein the release lever is configured to extend across a diameter of the disc clutch bracket, and wherein a first end of the release lever pivotably coupled to the disc clutch bracket, and wherein a second end of the release lever is operably coupled to the first portion of the cable assembly,

wherein in response to actuation of the lever assembly, the release lever is configured to pivot in a direction toward the disc clutch bracket thereby causing the disc clutch assembly to move from the engaged position to the disengaged position;

wherein the disc clutch assembly further comprises a biasing mechanism, wherein the biasing mechanism is operably coupled to the release lever and the disc clutch bracket, wherein in response to actuation of the lever assembly, the release lever pivots to overcome a biasing force of the biasing assembly thereby causing the disc clutch assembly to move from the engaged position to the disengaged position; and

wherein the biasing mechanism is a spring.

13. The chute rotation assembly of claim 12, wherein the disc clutch assembly comprises a fixed disc and a chute rotator disc, wherein when the fixed disc and the chute rotator disc are in the disengaged position, the chute is enabled to rotate between the plurality of positions;

wherein the fixed disc is configured to lie in a first plane, and wherein the chute rotator disc is configured to lie in a second plane, the first plane and the second plane being parallel.

14. The chute rotation assembly of claim 12, wherein the chute comprises a deflector configured to control a height of a discharge stream of the ejected material,

wherein the lever assembly comprises a chute rotation lever and a chute discharge lever, wherein the chute rotation lever is configured to control the chute rotation assembly, and wherein the chute discharge lever is configured to control the deflector, and

wherein the chute rotation lever comprises a trigger, wherein in response to actuation of the trigger, the disc clutch assembly is configured to move from the engaged position to the disengaged position.

15. A chute rotation assembly for a snow removal device, the chute rotation assembly comprising:

a cable system, the cable system operably coupling a lever assembly of the snow removal device to the chute rotation assembly; and

a disc clutch assembly configured to move between an engaged position and a disengaged position in response to actuation of the lever assembly, wherein when the disc clutch assembly is in the disengaged position, a chute of the snow removal device is enabled to rotate between a plurality of positions;

wherein the disc clutch assembly comprises a fixed disc and a chute rotator disc, wherein when the fixed disc and the chute rotator disc are in the disengaged position, the chute is enabled to rotate between the plurality of positions;

wherein the fixed disc and the chute rotator disc each comprise a plurality of teeth, wherein the plurality of teeth of each of the fixed disc and the chute rotator disc are configured to be intermeshed when the fixed disc and the chute rotator disc are in the engaged position such that the chute is not enabled to rotate between the plurality of positions;

wherein each of the plurality of teeth is metal and is configured to extend perpendicularly, away from a respective surface of the fixed disc or the chute rotator disc out of a respective first plane or a second plane.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 11,846,078 B2
APPLICATION NO. : 16/616064
DATED : December 19, 2023
INVENTOR(S) : Mike Johnson et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

In Column 13, Claim 12, Line 39, “release lever pivotably” should read --release lever is pivotably--

In Column 14, Claim 15, Line 52, “a second plane” should read --second plane--

Signed and Sealed this
Twenty-sixth Day of March, 2024

Katherine Kelly Vidal

Katherine Kelly Vidal
Director of the United States Patent and Trademark Office